

CLAIMS

1. A module for purifying a fluid, in particular for purifying water, of the kind including a cylindrical container (30; 30') provided at a first of its axial ends with fluid inlet and outlet orifices (33<sub>1</sub>-33<sub>3</sub>; 33'<sub>1</sub>-33'<sub>3</sub>) communicating with the interior of the module, in which are housed pretreatment means (49; 49') for carrying out a first operation of purifying the fluid and treatment means (51; 51') for carrying out a second operation of purifying the fluid after the latter has been treated by the pretreatment means (49; 49'), which module is characterized in that the container (30; 30') is monolithic to form a disposable module (14; 14') and the interior thereof is divided by separator means (38-40; 38'-40') into an external cylindrical space (36; 36') and an internal cylindrical space (35; 35') communicating with each other via one or more passages (37; 37') in the vicinity of the second axial end of the container (30; 30'), the pretreatment means (49; 49') are pretreatment means known in the art, the treatment means include a cartridge (51; 51') known in the art of the kind including one or more selectively permeable membranes (54; 54') for dividing, by virtue of permeation through the membrane or membranes due to the action of a pressure gradient, the flow of fluid that has undergone the first purification operation and caused to flow tangentially to the membrane or membranes into a flow of permeate consisting of purified fluid that has passed through the membrane and therefore undergone two purification operations and a flow of retentate consisting of residual fluid that has not passed through the membrane or membranes, the pretreatment means (49; 49') and the cartridge (51; 51') are housed in the external cylindrical space (36; 36') and the internal cylindrical

space (35; 35'), respectively, the external cylindrical space (36; 36') communicates, at the same end as the first axial end of the container (30; 30'), with a first orifice (33<sub>1</sub>; 33'<sub>1</sub>) for feeding fluid to be purified to the pretreatment means (49; 49'), and the internal cylindrical space (35; 35') communicates separately, at the same end as the first axial end of the container (30; 30'), with a second orifice (33<sub>2</sub>; 33'<sub>2</sub>) for evacuating from the module (14; 14') the flow of permeate and with a third orifice (33<sub>3</sub>; 33'<sub>3</sub>) for evacuating from the module (14; 14') the flow of retentate.

2. A module according to claim 1, characterized in that the cartridge is a reverse osmosis, nanofiltration or ultrafiltration cartridge.

3. A module according to claim 2, characterized in that the reverse osmosis cartridge is of the kind including (i) a cylindrical enclosure (52; 52') and, concentric therewith, a hollow, perforated, central tube (53; 53'), the central tube (53; 53') sharing the axis (34; 34') of the cylindrical container (30; 30') with the external cylindrical space (36; 36') and the internal cylindrical space (35; 35'), (ii) one or more selectively permeable reverse osmosis treatment membranes (54; 54') between the cylindrical enclosure (52; 52') and the central tube (53; 53') and communicating with the central tube (53; 53') for collection by the latter of the flow of permeate and with the exterior of the reverse osmosis cartridge (51; 51') via the annular faces thereof between the cylindrical enclosure (52; 52') and the central tube (53; 53') at each axial end of the cylindrical enclosure, respectively to feed the reverse osmosis cartridge (51; 51') with fluid treated by the pretreatment means and for the outflow of retentate.

4. A module according to claim 3, characterized in that means (57; 57') for providing a sealed connection

between the separator means and the cylindrical enclosure (52; 52') of the reverse osmosis cartridge (51; 51') are attached to the cylindrical enclosure (52; 52') and extend around the cylindrical enclosure (52; 52').

5           5. A module according to any of claims 1 to 4, characterized in that the pretreatment means are chosen from the group comprising activated charcoal, polyphosphates and frontal filtration elements.

10           6. A module according to any of claims 1 to 5, characterized in that the container (30; 30') includes a cylindrical wall (31; 31') closed at the first axial end by a non-removable head (20; 20') for connecting the module (14; 14') to a fluid purification unit and including three parallel connectors (32<sub>1</sub>-32<sub>3</sub>; 32'<sub>1</sub>-32'<sub>3</sub>) in  
15 each of which is formed one of the three orifices (33<sub>1</sub>-33<sub>3</sub>; 33'<sub>1</sub>-33'<sub>3</sub>) and the cylindrical wall (31; 31') is closed at the second axial end by a non-removable bottom (23; 23').

20           7. A module according to claim 6, characterized in that the connectors (32<sub>1</sub>-32<sub>3</sub>; 32'<sub>1</sub>-32'<sub>3</sub>) extend globally perpendicularly to the axis (34; 34') of the cylindrical wall (31; 31') of the container.

25           8. A module according to claim 6 or claim 7, characterized in that the separator means include a cylindrical wall (38; 38'), a cylindrical skirt (39; 39'), and a ring (40; 40') respectively projecting from the internal face of the head (20; 20') and the internal face of the bottom (23, 23'), the skirt (39; 39') and the ring (40; 40') providing continuity of separation from a  
30 corresponding longitudinal end of the cylindrical wall (38; 38') to the head (20; 20') and to the bottom (23; 23'), respectively.

35           9. A module according to claim 8, characterized in that the head (20; 20') is fixed to the cylindrical wall (31; 31') of the container (30; 30') by gluing, rotation

welding, ultrasound welding or fusion welding their annular edges.

10. A module according to claim 8 or claim 9, characterized in that the cylindrical skirt (39; 39') of the head (20; 20') and the axial end of the cylindrical wall (38; 38') of the separator means at the same end as the first axial end of the container are either fixed together by gluing, rotation welding, ultrasound welding or fusion welding their annular edges or housed concentrically with one inside the other with a seal (75) between them.

11. A module according to claim 10, characterized in that the skirt (39; 39') of the head (20; 20') and the cylindrical wall (38; 38') of the separator means each have an annular recess (76) forming with the opposite recess (77) an annular housing for the seal (75).

12. A module according to any of claims 8 to 11, characterized in that the ring (40') of the bottom and the axial end of the cylindrical wall (38') of the separator means at the same end as the second axial end of the container are housed concentrically one inside the other.

13. A module according to any of claims 8 to 12, characterized in that the ring (40; 40') of the bottom is crenellated to form a plurality of passages (37; 37') allowing the external cylindrical space (36; 36') and the internal cylindrical space (35; 35') to communicate with each other.

14. A module according to claim 13, characterized in that the bottom (23; 23') of the container includes locating means (46; 79) for holding the cylindrical wall (38; 38') of the separator means at an axial distance from the internal face (67; 67') of the bottom to allow fluid to flow from the external cylindrical space (36; 36') to the internal cylindrical space (35; 35') via the

crenellations (37; 37') of the crenellated ring (40; 40').

15        15. A module according to claim 14, characterized in that the crenellated ring (40) includes recesses (46) between the crenellations (37) and forming axial abutments serving as locating means for the cylindrical wall (38) of the separator means.

10        16. A module according to claim 14, characterized in that the locating means take the form of patterns (79) projecting from the internal face (67') of the bottom of the container.

15        17. A module according to any of claims 8 to 16, characterized in that the perimeter of the cylindrical wall (38; 38') of the separator means has in the vicinity of each axial end of the cylindrical wall centering fingers (45; 45') extending radially as far as the cylindrical wall (31; 31') of the container (30; 30') and serving to place the axis of the cylindrical wall on the axis (34; 34') of the container.

20        18. A module according to any of claims 2 to 17, characterized in that the head (20; 20') and the bottom (23; 23') of the container include nesting type retaining means (60, 61; 60', 61') for the cartridge.

25        19. A module according to claim 18, characterized in that the head (20; 20') and the bottom (23; 23') each include a bush (60, 61; 60', 61') housing a respective axial end portion of the central tube (53; 53') and one or more seals (62; 62') are disposed between the latter and the central bush (60; 60') of the head (20; 20'), the latter bush (60; 60') communicating with the second orifice (33<sub>2</sub>; 33'<sub>2</sub>).

30        20. A module according to claim 19, characterized in that the seal or each seal (62; 62') is housed in a groove (63; 63') formed in the central tube (53; 53').

35        21. A module according to claim 19 or claim 20,

characterized in that a central truncated cone (81) for positioning the cartridge (51'), operative inside the central tube (53') of the latter, projects from the internal face (67') of the bottom (23') of the container, concentrically with the bush (61') of the bottom and over a length greater than that of the bush.

22. A module according to any of claims 8 to 21, characterized in that there is a perforated or porous disk (50; 50') in the vicinity of each axial end of the container (30; 30') and between the cylindrical walls (31, 38; 31', 38') of the latter to retain the pretreatment means (49; 49') in the external cylindrical space (36; 36') whilst allowing the fluid to be purified to pass.

23. A module according to any of claims 2 to 22, characterized in that the central tube (53; 53') is closed at the same end as the annular face (55; 55') of the reverse osmosis cartridge (51; 51') through which the fluid enters the cartridge.